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Abstracts

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OTHER DATA?

Simulating improved combinations tillage-rotation under dryland conditions

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Introduction

The adequate combination of reduced tillage and crop rotation could increase the viability of dry land agriculture in Mediterranean zones. Crop simulation models can support to examine various tillage-rotation combinations and explore management scenarios. The decision support system for agrotechnology transfer (DSSAT) (Hoogenboom et al.,2010) provides a suite of crop models suitable for this task. The objective of this work was to simulate the effects of two tillage systems, conventional tillage (ConvT) and no tillage (NoT), and three crop rotations, continuous cereal (CC), fallow-cereal (FallowC) and legume-cereal (LegumeC), under dry conditions, on the cereal yield, soil organic carbon (SOC) and nitrogen (SON) in a 15-year experiment, comparing these simulations with field observations.

Materials and methods

The data used in this simulation study comes from a field experiment in La Canaleja located in Alcala de Henares (Madrid, Spain; Martin Lammerding et al.,.2011). Genetic coefficients of the CERES-Barley model were calibrated using observed dates of planting, harvest and anthesis together with biomass and yield. Daily weather and soil parameters were measured at the site.

Results and Discussion

Barley biomass and yield were properly simulated with DSSAT. Both simulated and observed values showed the same tendency through time (Fig. 1). SOC and SON were also satisfactorily simulated compared with the field observations (Fig.2).

Barley grain yield was lower for continuous cereal than for the FallowC and the LegumeC rotations, for both tillage managements. However, CERES-Barley did not reflect that reduction consistently. Only some years showed reduced yield in the continuous barley simulations. The model however, simulated correctly higher yields in the ConvT than in the NoT. Simulations also suggested that N immobilized in soil was higher in NoT than in ConvT. This fact could explain the lower yield in NoT, since N available is lower in that management. The larger presence of weeds in the NoT plots also affected the yield, but this was not simulated with DSSAT. Observed and simulated SOC exhibited similar trends decreasing with depth. This reduction with depth was sharper in NoT than in ConvT. SOC in the top 15 cm of soil was higher with NoT management than with ConvT management in both simulated and observed values. The SON showed the same tendency as SOC. A higher concentration of SON in the first 15 cm of soil in NoT than in ConvT, and a reduction with depth in all the studied years was observed and simulated.

These results suggest that ConvT-LegumeC and ConvT-FallowC were the best combinations for the dry land conditions studied. However, ConvT had the lowest SON and SOC while NoT kept higher SOC and SON. This is an example of how models can be a very useful tool for

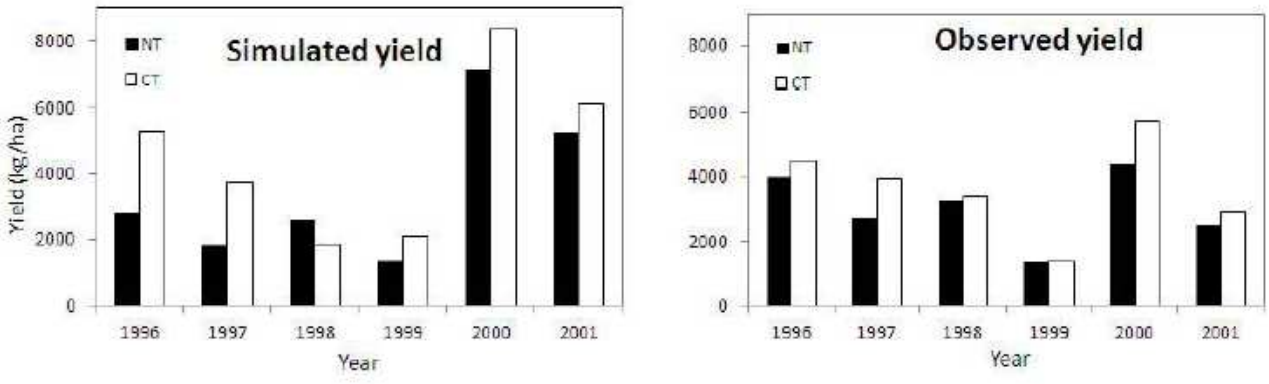

Fig 1. Observed and simulated barley yield in no tillage (NL) and conventional till age (CT).

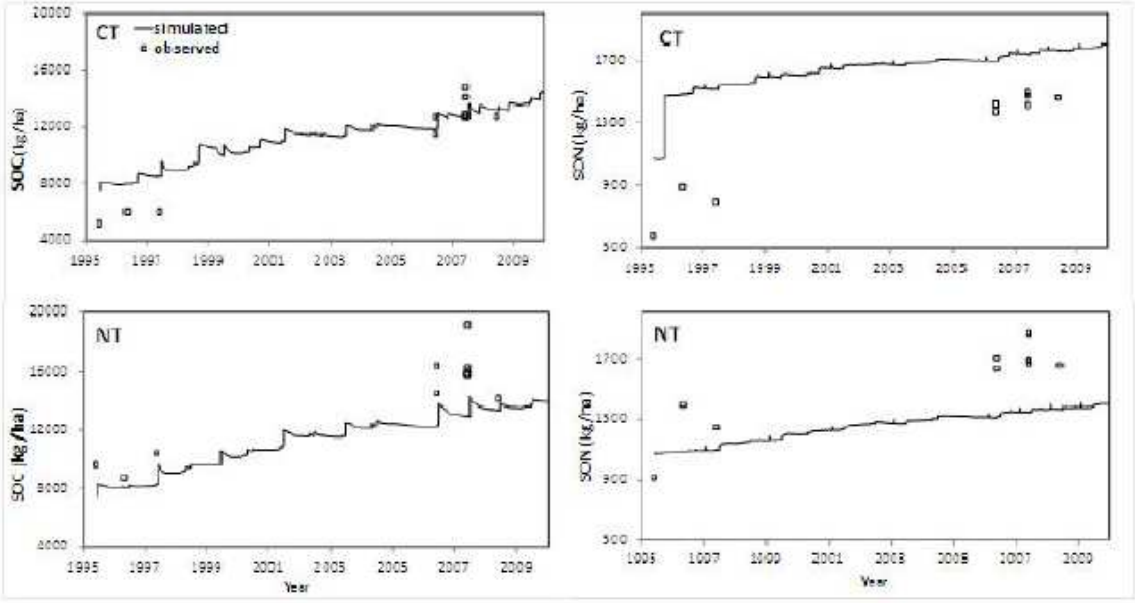

Fig 2. Observed and simulated SOC and SON in no tillage (NL) and convertional tillage (CT) in the top layer (0-15 cm)

assessing and predicting crop growth and yield under different managements.

Conclusions

In summary, ConvT-LegumeC and ConvT-FallowC provided the best yield but NoT treatments had the highest SON and SOC improving soil quality. Complementary economic and energy balance evaluations are needed to decide which are the best management practices for the area.

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